

IT IS CLAIMED:

1. Vacuum apparatus for treating articles, comprising:

a housing forming adjacent vacuum processing and load lock chambers with a first opening therebetween and a second opening between the load lock chamber and outside of the housing,

5 a surface within the processing chamber that is moveable between at least first and second positions, wherein the first surface position covers and seals said first opening, and wherein the second surface position is removed within the processing chamber a distance away from said wall in order to allow articles to be moved through the first opening between the processing and load lock chambers,

10 a cover provided adjacent the second opening that is moveable between at least first and second positions, wherein the first cover position seals said second opening from the outside, and wherein the second cover position allows articles to be passed through the second opening between the load lock chamber and the outside, and

15 at least one vacuum pump connectable (1) to reduce pressure within the processing chamber when either the surface or the cover are in their first positions, and (2) to reduce pressure within a load lock chamber when both of the surface and the cover are in their said first positions.

2. The vacuum apparatus of claim 1, wherein the first and second openings are located at opposite ends of a passage through in a top wall of the housing and the surface is vertically moveable between its said first and second positions.

3. A vacuum chamber and a load lock chamber through which articles are moved into and out of the vacuum chamber for processing, comprising:

a housing enclosing a compartment that includes an opening through a top wall thereof through which the articles may be moved,

5                   an article support surface within the compartment that is moveable between at least first and second positions, wherein the first support surface position covers and seals said opening by contacting an underside of the top wall around the opening in a manner that articles may be moved through the opening between outside of the housing and said surface, and wherein the second support surface  
10                  position is removed within the compartment a distance downward away from said top wall,

15                  a cover provided outside of the compartment that is moveable between at least first and second positions, wherein the first cover position covers and seals said opening by contacting a top side of the top wall around the opening, and wherein the second cover position is removed a distance away from the top wall sufficient to allow articles to be passed through the opening,

20                  at least one vacuum pump connectable (1) to reduce pressure within the vacuum chamber that is formed within the compartment when either the article support surface or the cover are in their first positions, and (2) to reduce pressure within the load lock chamber that is formed within the compartment when both of the article support surface and cover are in their said first positions, and

25                  a transport mechanism within the housing that moves articles between the article support surface when in its said second support surface position and a processing location removed from the second support surface position within the vacuum chamber.

4.                 The combination of claim 3, wherein the transport mechanism includes at least one pivotal arm that simultaneously engages two articles that are respectively on the article support surface when in its said second position and in the processing location, wherein rotation of the pivotal arm substantially one-hundred  
5                  eighty degrees about an axis thereof exchanges positions of the two articles.

5.                 The combination of claim 4, wherein the transport mechanism also includes a sub-mechanism that cooperates with the pivotal arm to move two

articles linearly toward and away from each other, wherein rotation of the pivotal arm substantially one-hundred eighty degrees about an axis thereof exchanges  
5 positions of the two articles when held toward each other.

6. The combination of claim 5, wherein the sub-mechanism includes a swinging arm to which the axis of said pivotal arm is attached.

7. The combination of claim 5, wherein the sub-mechanism includes additional arms pivotally mounted at ends of said pivotal arm.

8. The combination of claim 3, wherein the transport mechanism includes a carriage that moves the article support surface between the second support surface position and the processing location, said carriage including an opening for a mechanism to extend therethrough to move the article support surface  
5 between said first and second positions and be withdrawn below the carriage to allow its said lateral movement while the support surface rests thereon.

9. The combination of claim 3, wherein the transport mechanism includes a third position within the vacuum chamber for temporarily positioning articles while other articles are moved between the second support surface position and the processing location.

10. The combination of any one of claims 3-9, which comprises articles in the form of wedge shaped segments of a circular domed wafer carrier.

11. The combination of claim 10, wherein the wedge shaped segments are truncated along an edge opposite of a curved edge.

12. A mechanism for moving articles between a first position in a load lock chamber and a second position in an adjacent chamber that processes the articles, comprising:

5 an arm mounted to pivot about a point intermediate of said first and second locations,

a sub-mechanism cooperating with the pivot arm that moves articles to a position closer together than when positioned at the first and second locations, and

10 causes the sub-mechanism to move articles from said first and second locations to said positions closer together, then causes the pivot arm to rotate substantially one-hundred eighty degrees about its pivot point and thereafter causes the sub-mechanism to move the articles from said positions closer together to the first and second locations, whereby the positions of the articles at the first and second  
15 locations are exchanged.

13. The mechanism of claim 12, wherein the sub-mechanism includes a swinging arm to which the axis of said pivot arm is attached.

14. The mechanism of claim 12, wherein the sub-mechanism includes additional arms pivotally mounted at ends of said pivot arm.

15. The mechanism of any one of claims 12-14, which comprises articles in the form of wedge shaped segments of a circular domed wafer carrier.

16. The mechanism of claim 15, wherein the wedge shaped segments are truncated along an edge opposite of a curved edge.

17. A method of transferring articles into and out of a vacuum processing chamber through a load lock chamber, comprising:

5 forming the load lock chamber around an opening through a wall of an enclosure by an article supporting surface that is sealed to the inside of the wall around the opening and a cover that is sealed to the outside of the wall around the opening, wherein the processing chamber is formed within remaining portions of the enclosure,

10 moving articles between the load lock chamber and outside of said wall by removing the cover from its seal with the wall while the article supporting surface remains sealed to the wall,

providing an opening between the load lock chamber and the processing chamber by moving the article supporting surface away from the wall while the cover is sealed with the outside of the wall around the opening, and

15 thereafter moving articles between the load lock chamber and the processing chamber through said opening.

18. The method of claim 17, wherein moving articles between the load lock chamber and the processing chamber includes simultaneously swapping the locations of a first article in the load lock chamber and a second article in the processing chamber.

19. The method of claim 18, wherein swapping of the first and second articles includes moving said articles toward each other, then rotating the articles together through substantially one-hundred eighty degrees and thereafter moving said articles away from each other.

20. The method of any one of claims 17-19, wherein the first and second articles are each domes carrying a plurality of integrated circuit wafers for processing.

21. The method of any one of claims 17-19, wherein the first and second articles are wedge shaped portions of circular domes carrying a plurality of integrated circuit wafers for processing.

22. The method of claim 21, wherein the wedge shaped dome portions are truncated along a side opposite to a circular side.

23. The method of claim 21, wherein the wafers are processed by depositing material there over from evaporation within the processing chamber.

24. The method of claim 17, wherein moving articles between the load lock chamber and the processing chamber includes moving the article supporting surface with articles thereon laterally between the load lock chamber and the processing chamber.

25. The method of claim 17 wherein moving articles between the load lock chamber and the processing chamber includes:

moving articles from one of the load lock chamber or the processing chamber to a separate exchange location within the vacuum chamber,

thereafter moving articles from the other of the load lock chamber or the processing chamber to said one of the load lock chamber or processing chamber, and

thereafter moving articles from the exchange location to said other of the load lock chamber or the processing chamber.

26. A method of moving articles between a vacuum processing chamber and a load lock chamber, comprising:

moving at least one article in the processing chamber and at least one article in the load lock chamber towards each other,

5           thereafter, simultaneously rotating the articles about a point located between them through substantially one-hundred eighty degrees, and

              thereafter, moving the articles away from each other into the processing and load lock chambers, whereby the positions of the articles have been swapped.

27.       The method of claim 26 wherein the articles that are moved include domes carrying a plurality of integrated circuit wafers for processing.

28.       The method of claim 26, wherein the articles that are moved are wedge shaped portions of circular domes carrying a plurality of integrated circuit wafers for processing.

29.       The method of claim 28, wherein the wedge shaped dome portions that are moved are truncated along a side opposite to a circular side.

30.       A method of processing articles within a vacuum chamber and moving the articles between the vacuum chamber and the outside through a load lock chamber, during sequential time intervals, comprising:

5           during a first time interval, opening the load lock chamber to the outside while remaining closed to the vacuum chamber, simultaneously removing a previously processed first batch of one or more articles from the load lock chamber to the outside and loading a second batch of one or more articles from the outside into the load lock chamber, while a third batch of one or more articles is being processed in the vacuum chamber,

10          during a second time interval, closing the load lock chamber to the outside, reducing the pressure within the load lock chamber to substantially that of the vacuum chamber, and opening the load lock chamber to the vacuum chamber, while the third batch of one or more articles is being processed in the vacuum chamber

15                   during a third time interval, simultaneously moving the second batch  
of one or more articles from the load lock chamber to the vacuum chamber and  
moving the third batch of one or more articles from the vacuum chamber to the load  
lock chamber,

20                   during a fourth time interval, closing the load lock chamber from the  
vacuum chamber and then venting the load lock chamber to the outside, while the  
second batch of one or more articles is being processed in the vacuum chamber, and

25                   during a fifth time interval, opening the load lock chamber to the  
outside while remaining closed to the vacuum chamber, simultaneously removing the  
third batch of one or more articles from the load lock chamber to the outside and  
loading a fourth batch of one or more articles from the outside into the load lock  
chamber, while the second batch of one or more articles is being processed in the  
vacuum chamber.

31.       The method of claim 30, wherein moving and processing the  
first, second, third and fourth batches of one or more articles includes moving a  
domed surface carrying a plurality of integrated circuit wafers and processing said  
integrated circuit wafers.

32.       The method of claim 31, wherein the domed surface is formed  
of a plurality of wedge shaped pieces that are removeably placed together on a  
frame, and each of the moving and removing of a domed surface includes  
sequentially moving one of the wedge shaped pieces at a time.

33.       A method of moving a plurality of integrated circuit wafers  
from one location to another location, comprising:

                 positioning the plurality of wafers across a plurality of wedge shaped  
pieces that are fit together on a first frame to form a domed surface,

5 moving one of the wedge shaped pieces at a time from the first frame to a second frame until all of said plurality of wedge shaped pieces are moved from the first frame to the second frame.

34. A carrier of integrated circuit wafers, comprising:  
a circular frame,  
a plurality of wedge shaped pieces supported on the frame to collectively form a domed surface across which wafers are positionable, and  
5 an carrying element attached to the individual wedge shaped pieces in a position such that the wedge shaped piece with wafers thereon is balanced when lifted off the frame by attachment only with the carrying element.

35. The carrier of claim 34, wherein pointed ends of the individual wedge shaped pieces are truncated.

36. A method of moving articles between a vacuum processing chamber and a load lock chamber, comprising:  
connecting one end of a transfer arm to at least one article in the processing chamber and another end of the transfer arm to at least one article in the  
5 load lock chamber,  
thereafter, simultaneously rotating the transfer arm and articles connected thereto through substantially one-hundred eighty degrees about a point intermediate of the ends of the transfer arm, and  
thereafter, removing the articles from the ends of the arm in the  
10 processing and load lock chambers, whereby the positions of the articles have been swapped simultaneously.

37. A method of moving articles between a vacuum processing chamber and a load lock chamber, comprising:

moving articles from one of the load lock chamber or the processing chamber to a separate exchange location within the vacuum chamber,

5 thereafter moving articles from the other of the load lock chamber or the processing chamber to said one of the load lock chamber or processing chamber, and

thereafter moving articles from the exchange location to said other of the load lock chamber or the processing chamber.

38. A method of moving at least one article between a vacuum processing chamber and a load lock chamber, comprising:

5 providing a carriage that is horizontally movable between the vacuum processing and load lock chambers through a gate valve positioned between said chambers when the gate valve is opened,

positioning said at least one article on the carriage when in one of the vacuum processing and load lock chambers, and

thereafter moving the carriage with said at least one article thereon to another of the vacuum processing and load lock chambers.